القسم : الرياضيات [illegible] — [illegible]

[illegible] — [illegible]

[illegible]

- [illegible]

[illegible]

- [illegible]

[illegible] θ [illegible] φ [illegible]

ψ [illegible]

- [illegible]

$$\vec{V}(M) = \vec{\omega} \wedge \vec{r}$$

- [illegible]

$$\vec{\omega} = p_1\vec{I}_1 + q_1\vec{J}_1 + r_1\vec{K}_1$$

حيث

$$p_1 = \dot{\theta}\cos\psi + \dot{\varphi}\sin\theta\sin\psi$$

$$q_1 = -\dot{\theta}\sin\psi + \dot{\varphi}\sin\theta\cos\psi$$

$$r_1 = \dot{\psi} + \dot{\varphi}\cos\theta$$

- [illegible]

$$\omega = p\vec{i} + q\vec{j} + r\vec{k}$$

حيث

$p = \dot{\theta} \cos\varphi + \dot{\psi} \sin\theta \sin\varphi$

$q = \dot{\theta} \sin\varphi - \dot{\psi} \sin\theta \cos\varphi$

$r = \dot{\varphi} + \dot{\psi} \cos\theta$

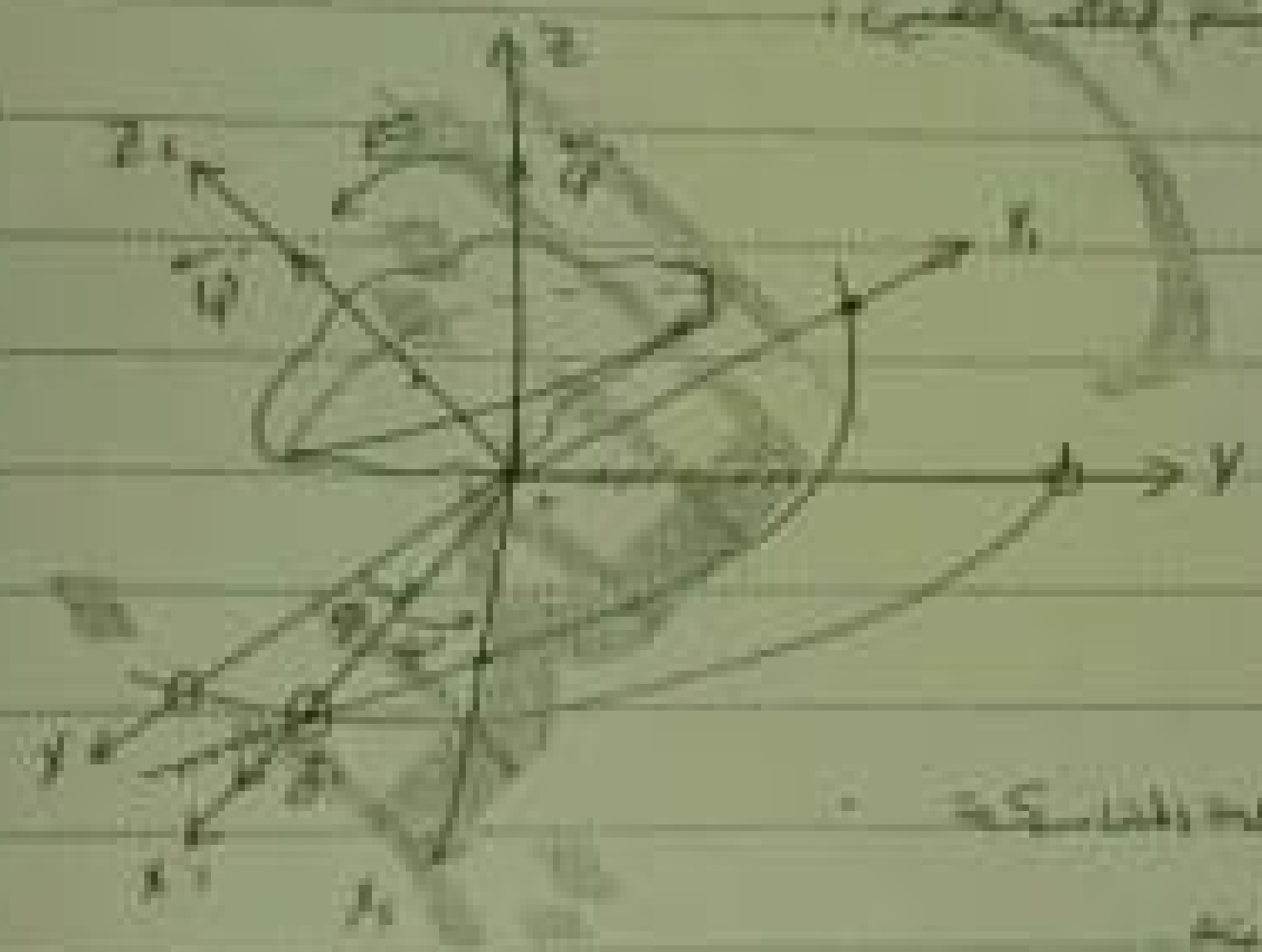
• معادلة سطح المخروط [illegible]:

$$\frac{x}{p} = \frac{y}{q} = \frac{z}{r}$$

• معادلة سطح المخروط [illegible]:

$$\frac{x_1}{p_1} = \frac{y_1}{q_1} = \frac{z_1}{r_1}$$

رسم [illegible]:



• [illegible]

○ [illegible]

○ θ [illegible] OZ

• مسألة:

إذا كانت [illegible] شكل كرة تتحرك [illegible]

ب) أي نقطة ثابتة عند سكونها بالنظام.

[2] - حسب المعطاة المستقلة المتحركة لتعيين موضع [illegible] الجسم.

[3] - [illegible] مع الشروط السابقة [illegible] [illegible] [illegible] المستوي [illegible] [illegible] [illegible] [illegible].

أ- حدد المعطاة المستقلة اللازمة لتعيين موضع المركز [illegible] الجسم.

ب- [illegible] (ρ, φ, z) و (ρ, φ, θ)

ج- [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

[4] - [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] $\frac{a}{2}$ [illegible] [illegible].

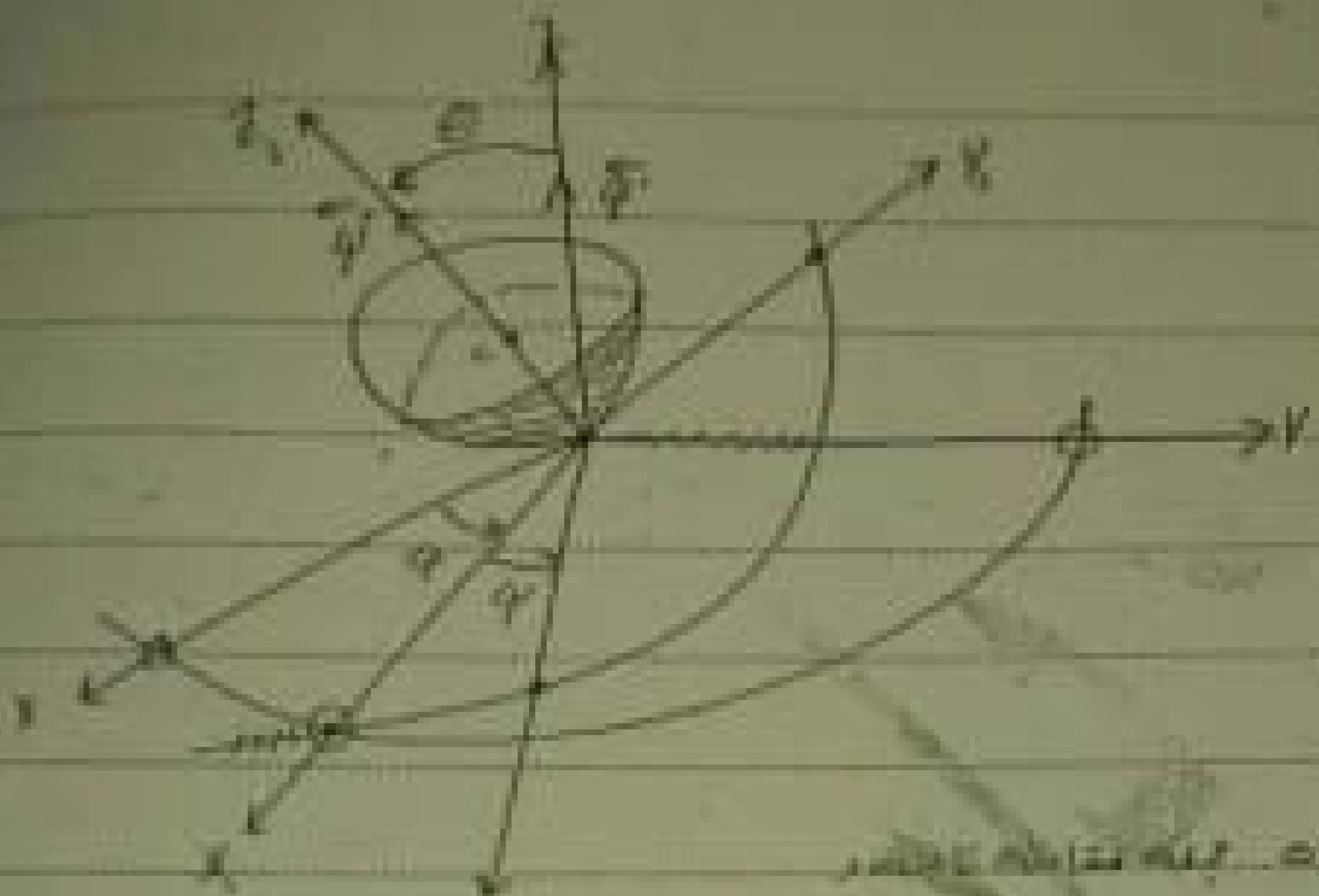
أ- حدد المعطاة المستقلة [illegible].

ب- [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

ج- [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

الملخص:

[1]



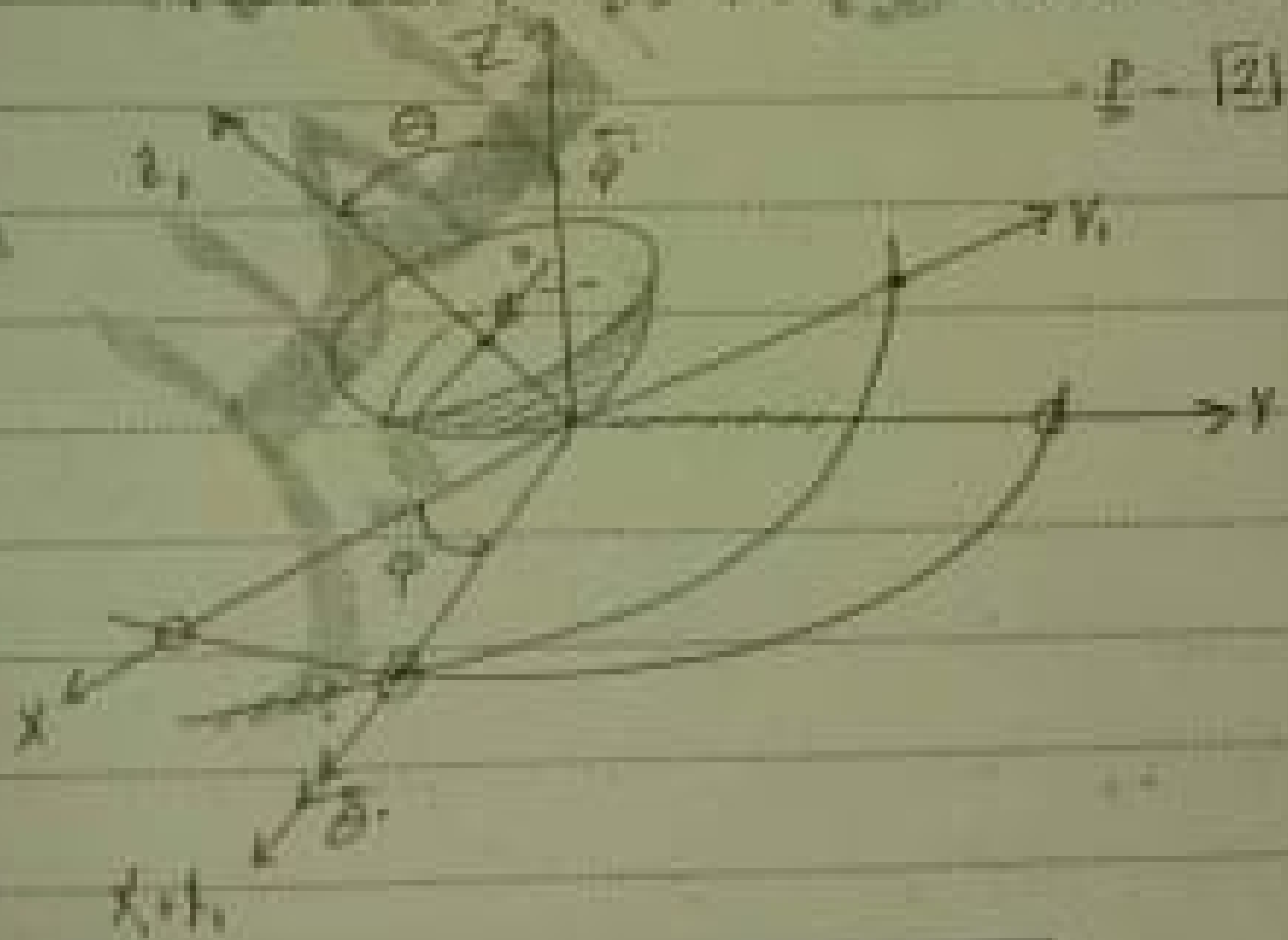
oxyz .. جملة محاور ثابتة

$ox_1y_1z_1$ [illegible]

[illegible]

[illegible] (θ ، φ ، ψ) [illegible]

[2] - ب



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

الترنح

[illegible]

$$p_1 = \dot{\theta} \cos\varphi + \dot{\psi} \sin\theta \sin\varphi$$

$$q_1 = \dot{\theta} \sin\varphi - \dot{\psi} \sin\theta \cos\varphi$$

$$r_1 = \dot{\varphi} + \dot{\psi} \cos\theta$$

ولكن $\varphi = 0$ نعوض فإنه

$$p_1 = \dot{\theta} \qquad q_1 = -\dot{\psi} \sin\theta \qquad r_1 = \dot{\psi} \cos\theta$$

$$\therefore p_1 i + q_1 j + r_1 k = (\dot{\theta}, -\dot{\psi} \sin\theta, \dot{\psi} \cos\theta)$$

$$p = \dot{\theta} \cos\varphi + \dot{\psi} \sin\theta \sin\varphi$$

$$q = \dot{\theta} \sin\varphi - \dot{\psi} \sin\theta \cos\varphi$$

$$r = \dot{\varphi} + \dot{\psi} \cos\theta$$

ولكن $\psi = 0$ نعوض

$p = \theta' \cos\phi$ & $q = \theta' \sin\phi$ & $r = \phi'$

$(p, q, r) = (\theta' \cos\phi, \theta' \sin\phi, \phi')$

في ∴ سطح، المخروط، المشتق:

$$\frac{x_1}{p_1} = \frac{y_1}{q_1} = \frac{z_1}{r_1}$$

$$\Rightarrow \frac{x_1}{\theta'} = \frac{y_1}{\phi' \sin\theta} = \frac{z_1}{\phi' \cos\theta}$$

(1) (2) (3)

من (1)، (2)

$$x_1 \phi' \sin\theta = \theta' y_1$$

من (1)، (3)

$$x_1 \phi' \cos\theta = \theta' z_1$$

بجمع وتربيع المعادلتين:

$$x_1^2 \phi'^2 = \theta'^2 (y_1^2 + z_1^2)$$

$$z_1^2 + y_1^2 = \left(\frac{\phi'}{\theta'}\right)^2 x_1^2$$

معادلة سطح مخروط دائري قائم رأسه $(0,0,0)$ ومحوره ox_1 ونصف زاويته الرأسية

$$\alpha = tg \frac{\phi'}{\theta'}$$

∴ سطح مخروط القاعدة

$$\frac{x}{p} = \frac{y}{q} = \frac{z}{r}$$

$$\Rightarrow \frac{x}{\theta' \cos\varphi} = \frac{y}{\theta' \sin\varphi} = \frac{z}{\varphi'}$$

(1) (2) (3)

(1) و (3)

$$x\varphi' = \theta' \cos\varphi \, z$$

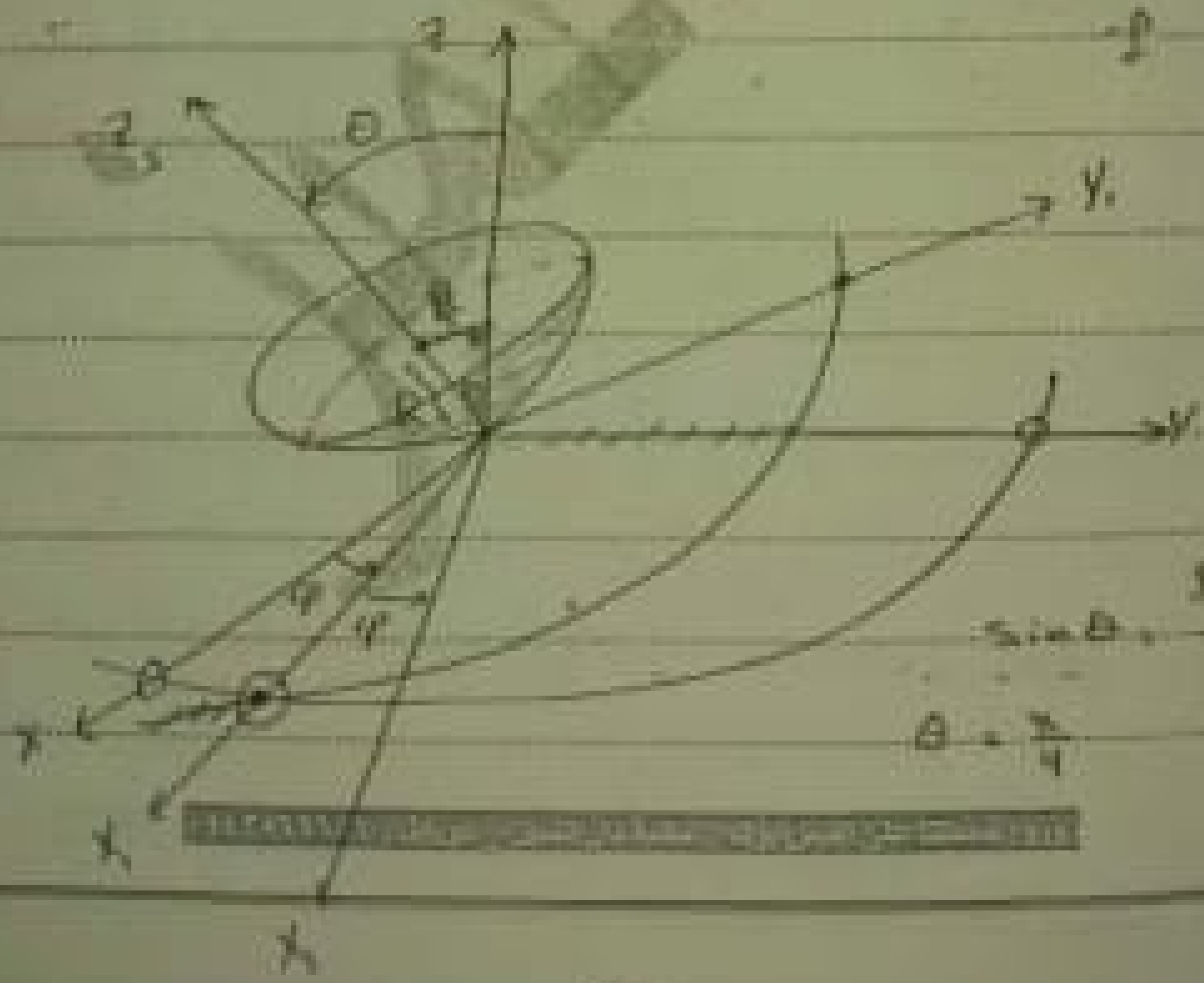
(2) و (3)

$$y\varphi' = \theta' \sin\varphi \, z$$

$$(x^2+y^2)\varphi'^2 = \theta'^2 z^2$$

$$x^2+y^2 = \left(\frac{\theta'}{\varphi'}\right)^2 z^2$$

$$= \tan\left(\frac{\theta'}{\varphi'}\right)$$



$$\sin\theta = \frac{R}{\sqrt{2}} = \frac{1}{2}$$

$$\theta = \frac{\pi}{4}$$

[illegible]

[illegible] $\alpha = \frac{\pi}{3}$, [illegible]

$\vec{\Omega} = p_1\vec{i_1} + q_1\vec{j_1} + r_1\vec{k_1}$ [illegible]

[illegible] $\vec{\omega} = p\vec{i} + q\vec{j} + r\vec{k}$

$$p_1 = \frac{1}{2}\dot{\varphi}\sin\psi$$

$$q_1 = \frac{1}{2}\dot{\varphi}\cos\psi$$

$$r_1 = \dot{\psi} + \frac{\sqrt{3}}{2}\dot{\varphi}$$

$$p = \frac{1}{2}\dot{\varphi}\sin\psi$$

$$q = \frac{1}{2}\dot{\varphi}\cos\psi$$

$$r = \dot{\psi} + \frac{\sqrt{3}}{2}\dot{\varphi}$$

[illegible]

ج - بنفس طريقة من الطلب (1)

مسألة [illegible]

(1) [illegible] A [illegible]

[illegible]

(1) [illegible] OZ [illegible]

[illegible]

(2) [illegible]

[illegible]

[3] [illegible]

[illegible]

[illegible]

$Oxyz$ [illegible]

$Ox_1y_1z_1$ [illegible]

[illegible] OA [illegible]

OZ_1 [illegible]

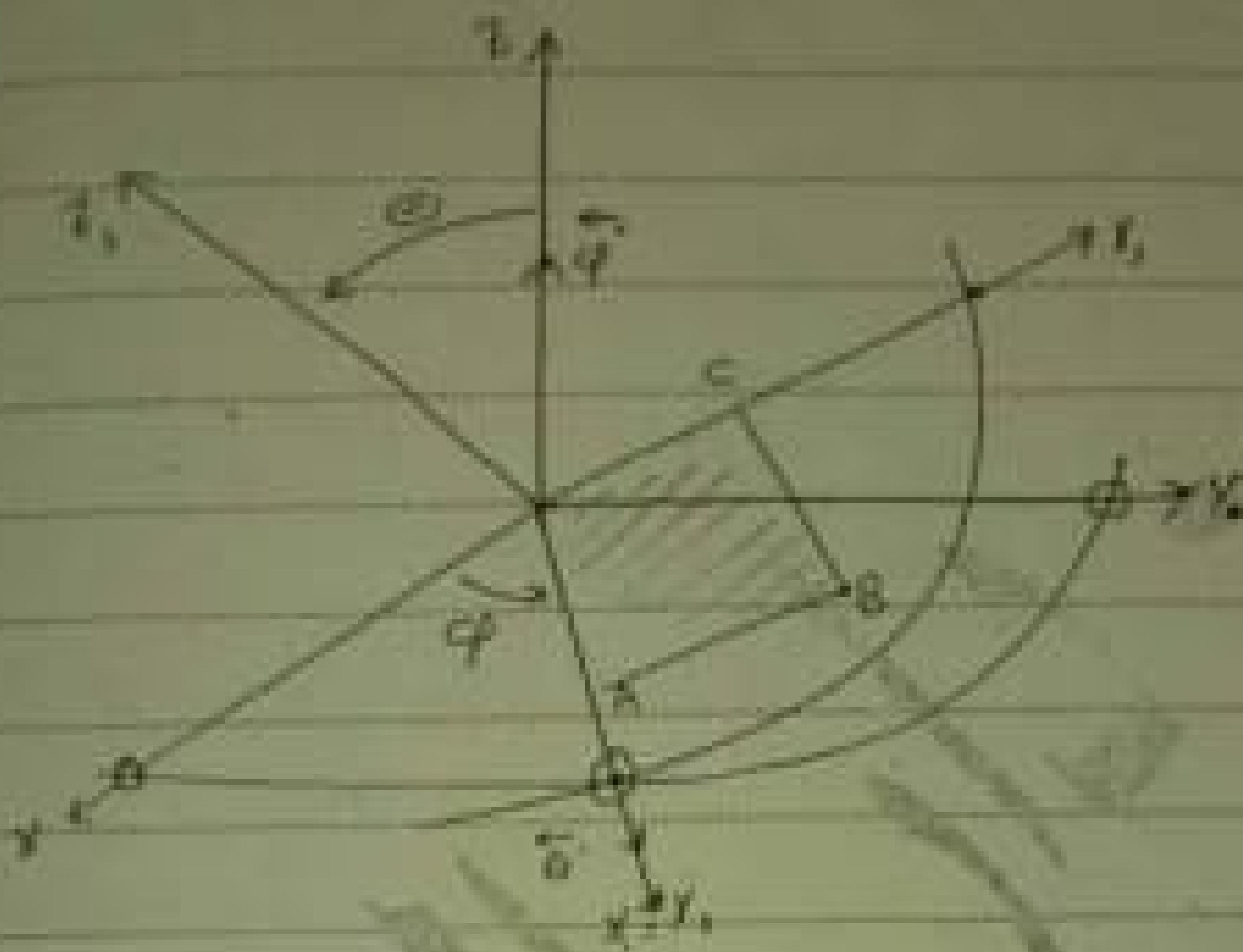
[illegible]

[illegible]

مسألة

جسم [illegible] يشكل [illegible] مستطيلة $OABC$ [illegible]

[illegible]



انتهت بحمد الله

مع تمنياتي لكم بالتوفيق والنجاح

AKRAD